

THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

B.Sc. STATISTICS

DEGREE COURSE

CBCS PATTERN

(With effect from 2012-2013)

The Course of Study and the Scheme of Examinations

| S.NO | Part | Study Components | | Ins. hrs /week | Credit | Title of the Paper | Maximum Marks | | |
|--------------------|------|------------------|-------------|----------------|-----------|----------------------------------|---------------|------------|------------|
| | | Course Title | | | | | CIA | Uni. Exam | Total |
| SEMESTER I | | | | | | | | | |
| 1 | I | Language | Paper-1 | 6 | 4 | Tamil/Other Languages | 25 | 75 | 100 |
| 2 | II | English | Paper-1 | 6 | 4 | English | 25 | 75 | 100 |
| 3 | III | Core Theory | Paper-1 | 6 | 4 | Descriptive Statistics | 25 | 75 | 100 |
| 4 | III | Core Practical | Practical | 3 | 0 | | 0 | 0 | 0 |
| 5 | III | ALLIED -1 | Paper-1 | 7 | 4 | Allied Mathematics- I | 25 | 75 | 100 |
| 7 | IV | Environ. Studies | | 2 | 2 | Environmental Studies | 10 | 40 | 50 |
| | | | | 30 | 18 | | 110 | 340 | 450 |
| SEMESTER II | | | | | | | | | |
| 8 | I | Language | Paper-2 | 6 | 4 | Tamil/Other Languages | 25 | 75 | 100 |
| 9 | II | English | Paper-2 | 4 | 4 | English | 25 | 75 | 100 |
| 10 | III | Core Theory | Paper-2 | 6 | 4 | Probability and Random Variables | 25 | 75 | 100 |
| 11 | III | Core Practical | Practical-1 | 3 | 3 | | 40 | 60 | 100 |
| 12 | III | ALLIED-1 | Paper-2 | 7 | 6 | Allied Mathematics -II | 25 | 75 | 100 |
| 14 | IV | Value Education | | 2 | 2 | Value Education | 10 | 40 | 50 |
| 15 | IV | Soft Skill | | 2 | 1 | Soft Skill | 10 | 40 | 50 |
| | | | | 30 | 24 | | 160 | 440 | 600 |

B.Sc. Statistics: Syllabus (CBCS)

| SEMESTER III | | | | | | | CIA | Uni. Exam | Total |
|--------------------|-----|---------------------|-------------|-----------|-----------|--|------------|------------------|--------------|
| 16 | I | Language | Paper-3 | 6 | 4 | Tamil/Other Languages | 25 | 75 | 100 |
| 17 | II | English | Paper-3 | 6 | 4 | English | 25 | 75 | 100 |
| 18 | III | Core Theory | Paper-3 | 3 | 5 | Distribution Theory | 25 | 75 | 100 |
| | III | Core Practical | Practical | 3 | 0 | | 0 | 0 | 0 |
| 19 | III | ALLIED-2 | Paper-3 | 4 | 4 | Numerical Methods | 15 | 60 | 75 |
| | III | Allied Practical | Practical | 3 | 0 | | 0 | 0 | 0 |
| 21 | IV | Skill based Subject | Paper-1 | 3 | 3 | Indian official Statistics | 15 | 60 | 75 |
| 22 | IV | Non-major elective | Paper-1 | 2 | 2 | Statistical Methods-I | 10 | 40 | 50 |
| | | | | 30 | 22 | | 115 | 385 | 500 |
| SEMESTER IV | | | | | | | CIA | Uni. Exam | Total |
| 23 | I | Language | Paper-4 | 6 | 4 | Tamil/Other Languages | 25 | 75 | 100 |
| 24 | II | English | Paper-4 | 6 | 4 | English | 25 | 75 | 100 |
| 25 | III | Core Theory | Paper-4 | 3 | 3 | Sampling Theory | 25 | 75 | 100 |
| | III | Core Practical | Practical-2 | 3 | 3 | | 40 | 60 | 100 |
| 26 | III | ALLIED-2 | Paper-4 | 4 | 4 | Programming in C | 15 | 60 | 75 |
| 27 | III | Allied Practical | Practical-1 | 3 | 2 | Numerical Methods and Programming in "C" | 10 | 40 | 50 |
| 28 | IV | Skill based Subject | Paper-2 | 3 | 3 | Industrial Statistics | 15 | 60 | 75 |
| 29 | IV | Non-major elective | Paper-2 | 2 | 2 | Statistical Methods-II | 10 | 40 | 50 |
| | | | | 30 | 25 | | 165 | 485 | 650 |
| SEMESTER V | | | | | | | CIA | Uni. Exam | Total |
| 30 | III | Core Theory | Paper-5 | 6 | 5 | Statistical Inference-I | 25 | 75 | 100 |
| 31 | III | Core Theory | Paper-6 | 5 | 5 | Statistical Quality Control | 25 | 75 | 100 |
| 32 | III | Core Theory | Paper-7 | 5 | 5 | Operations Research | 25 | 75 | 100 |
| 33 | III | Core Theory | Paper-8 | 5 | 4 | Applied Statistics | 25 | 75 | 100 |
| 34 | III | Core Practical | Practical | 3 | 0 | | 0 | 0 | 0 |

B.Sc. Statistics: Syllabus (CBCS)

| | | | | | | | | | |
|--------------------|-----|----------------------|-------------|-----------|-----------|--|------------|------------------|--------------|
| 35 | III | Elective | Paper-1 | 3 | 3 | (to choose 1 out of 3) A. Demography B. Data Base Management System C. Statistical Genetics | 25 | 75 | 100 |
| 36 | IV | Skill based Subject | Paper-3 | 3 | 3 | Applied decision making | 15 | 60 | 75 |
| | | | | 30 | 25 | | 140 | 435 | 575 |
| SEMESTER VI | | | | | | | CIA | Uni. Exam | Total |
| 37 | III | Core Theory | Paper-9 | 6 | 4 | Statistical Inference-II | 25 | 75 | 100 |
| 38 | III | Core Theory | Paper-10 | 6 | 4 | Design of Experiments | 25 | 75 | 100 |
| 39 | III | Core Theory | Paper-11 | 6 | 5 | Stochastic Processes | 25 | 75 | 100 |
| | III | Core Practical | Practical-3 | 3 | 3 | | 40 | 60 | 100 |
| 41 | III | Elective | Paper-2 | 3 | 3 | (to choose 1 out of 3) A. Mathematical Economics B. Real Analysis I C. Actuarial Statistics | 25 | 75 | 100 |
| 42 | III | Elective | Paper-3 | 3 | 3 | (to choose 1 out of 3) A. Regression Analysis B. Real Analysis II C. Econometric Methods | 25 | 75 | 100 |
| 43 | IV | Skill based Subject | Paper-4 | 3 | 3 | Statistical Data Analysis (Software Based-Practical) | 15 | 60 | 75 |
| 44 | V | Extension Activities | | 0 | 1 | | 50 | 0 | 50 |
| | | Total | | 30 | 26 | | 230 | 495 | 725 |

| Part | Subject | Papers | Credit | Total credits | Marks | Total marks |
|-------------|------------------------|---------------|---------------|----------------------|--------------|--------------------|
| Part I | Languages | 4 | 4 | 16 | 100 | 400 |
| Part II | English | 4 | 4 | 16 | 100 | 400 |
| Part III | Allied (Odd Sem) | 2 | 4 | 8 | 100 | 200 |
| | Allied (Even Sem) | 2 | 4 | 10 | 75 | 150 |
| | Allied -Prac(Even Sem) | 1 | 2 | 2 | 50 | 50 |
| | Electives | 3 | 3 | 9 | 100 | 300 |
| | Core | 11 | (3-7) | 48 | 100 | 1100 |
| | Core Practical | 3 | 3 | 9 | 100 | 300 |
| Part IV | Env. Science | 1 | 2 | 2 | 50 | 50 |
| | Soft skill | 1 | 1 | 1 | 50 | 50 |
| | Value Education | 1 | 2 | 2 | 50 | 50 |
| | Lang. & Others/NME | 2 | 2 | 4 | 50 | 100 |
| | Skill Based | 4 | 3 | 12 | 75 | 300 |
| Part V | Extension | 1 | 1 | 1 | 50 | 50 |
| | Total | 40 | | 140 | | 3500 |

THIRUVALLUVAR UNIVERSITY

B.Sc. STATISTICS

SYLLABUS

CBCS PATTERN

SEMESTER I

PAPER - 1

DESCRIPTIVE STATISTICS

Objective:

To enable the students understand and apply descriptive measures in Statistics.

UNIT - I

Nature and scope of statistical methods and their limitations - preparation of questionnaire and schedule - Primary and Secondary sources of data - nominal, ordinal, ratio and interval scale - complete enumeration, controlled experiment, observational studies & sample surveys, Sources of secondary data including some Government publications.

UNIT – II

Presentation by tables and by diagrams- Construction of tables with one, two and three factors of classifications - Diagrammatic representations, frequency distributions for continuous and discrete data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods) and Ogives. Measures of Location.

UNIT – III

Measures of dispersion, moments, measures of skewness and kurtosis for both grouped and ungrouped data.

UNIT – IV

Scatter diagram, regression lines and concept of error in regression, principle of least squares and fitting of first, second degree and exponential curves, concept of correlation co-efficient and its properties. Spearman's rank correlation. Regression Equations.

UNIT – V

Fundamental set of frequencies, Consistency of data, conditions for consistency, contingency table, association of attributes.

Books for Study:

1. Hogg, R.V. and Craig, A.T. (1998): Introduction to Mathematical Statistics, 4th ed. Academic Press.
2. Hoel, P.G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
3. Goon, AM., Gupta M.K and .Dasgupta B (1991): Fundamentals of Statistics, Vol.1, World Press, Calcutta.
4. Bhat B.R, Srivenkataramana T, and Madhava K.S,(1996) Statistics: A Beginner's text Vol. I, New Age International (P) Ltd.
5. Gupta,S.P.:Statistical methods,Sultan Chand & Sons Pvt Ltd.New Delhi.

Books for Reference:

1. G.U.Yule and M.G. Kendall (1956): An introduction to the theory of Statistics, Charles Griffin.
2. M.R. Spiegel (1961): Theory and problems of statistics, Schaum's outline series.
3. Snedecor .G.W. and Cochran W.G. (1967): Statistical methods, Iowa State University Press.
4. Anderson, T.W. and Sclove SL. (1978): An introduction to statistical analysis of data, Houghton Mifflin/co.
5. Croxton FE, and Cowden D.J. (1973) Applied General Statistics, Printice Hall of India.

ALLIED - 1
MATHEMATICS – I

Objectives of the Course:

To Explore the Fundamental Concepts of Mathematics

UNIT-I: ALGEBRA

Partial Fractions - Binomial, Exponential and logarithmic Series (without Proof) - Summation - Simple problems

UNIT-II : THEORY OF EQUATIONS

Polynomial Equations with real Coefficients - Irrational roots - Complex roots- Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations - Newton's method to find a root approximately - Simple problems.

UNIT-III : MATRICES

Symmetric - Skew-Symmetric - Orthogonal and Unitary matrices - Rank of a matrix -Consistency of equations - Eigen roots and eigen vectors - Cayley-Hamilton theorem (without proof)- Verification and computation of inverse matrix

UNIT-IV: TRIGONOMETRY

Expansions of $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ - Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ - Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers.

UNIT-V: DIFFERENTIAL CALCULUS

n-th derivatives - Leibnitz theorem (without proof) and applications – Jacobians -Concepts of polar co-ordinates-Curvature and radius of curvature in Cartesian co-ordinates.

Recommended Text:

1. P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics*, Vol. I & II. Muhil Publishers, Chennai.

Reference Books:

1. P.Balasubramanian and K.G.Subramanian,(1997) *Ancillary Mathematics*. Vol. I & II. Tata McGraw Hill, New Delhi.
2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II. Vikas Publications, New Delhi.
3. P.R.Vittal (2003) *Allied Mathematics* . Marghan Publications, Chennai
4. P.Kandasamy, K.Thilagavathy (2003) *Allied Mathematics Vol-I, II* S.Chand & company Ltd., New Delhi-55.
5. Isaac, *Allied Mathematics*. New Gamma Publishing House, Palayamkottai.

SEMESTER II
PAPER – 2
PROBABILITY AND RANDOM VARIABLES

Objective:

Enable the students to understand and study random phenomena mathematically

UNIT – I

Random experiment, sample point, sample space, event, algebra of events, operations on events. Classical and relative frequency approach to probability - axiomatic approach to probability. Simple problems.

UNIT – II

Addition theorem of probability, conditional probability, independence of events multiplication theorem - Bayes theorem and its applications.

UNIT – III

Definition of discrete and continuous random variables-Distribution functions - probability mass function, probability density functions and their properties. Expectation of random variables and its properties.

UNIT – IV

Moment generating function, characteristic function, cumulant generating function - their properties, moments, measures of locations, dispersion, Skewness and Kurtosis for discrete and continuous variates. Simple problems

UNIT – V

Bivariate distributions - discrete and continuous type, cumulative distribution function (c.d.f.), and probability mass function (p.m.f) and probability density function (p.d.f.) Marginal and Conditional expectation.

Books for Study:

1. A.M.Mood, F.A. Graybill and D.C. Boes (1974): Introduction to the theory of Statistics, International student ed. McGraw Hill.

2. Hogg, R.V. and Craig, A.T. (1998): Introduction to Mathematical Statistics, 4th ed. Academic Press.
3. A.M.Goon, M.K.Gupta & B. Dasgupta (1980): An outline of Statistical theory, Vol. I, 6th revised, World Press.

Books for Reference:

1. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics.
2. P.G.Hoel (1971): Introduction to Mathematical Statistics, Asia publishing house.
3. Murry R. Spiegel (1982): Theory and problems of Probability and Statistics, Schaum's outline series, McGraw Hill.
4. Seymour Lipshutz (1982): Theory and problems of probability, Schaum's outline series, McGraw Hill.
5. Marek Fisz (1961): Probability theory and Mathematical Statistics, John Wiley.
6. K.L.Chung (1983): Elementary probability theory with stochastic processes, Springer International student edition.
7. William.Feller (1968): An introduction to probability theory and its applications, Vol. I, 3rd ed., John Wiley & Sons.

CORE PRACTICAL – I

Practical I : (Based on core paper 1 and 2)

1. Construction of Uni-variate,bi-variate frequency distributions,
2. Diagrammatic and graphical representations.
3. Ogives,Lorenz curves,
4. Measures of location, dispersion
5. Measures of skewness and kurtosis for both grouped and ungrouped data.
6. Measures of skewness and kurtosis using moments.
7. Principle of least squares and fitting of first, second degree and exponential curves.
8. Computation of correlation co-efficient.
9. Rank correlation.
10. Regression Equations.
11. Construction of contingency table.
12. Association of Attributes.
13. Join Probability mass function, Join probability density function, Marginal probability mass and density functions.
14. Expectation, variance and Correlation coefficient.

ALLIED - 1
PAPER - 2
MATHEMATICS – II

Objectives of the Course

To Explore the Fundamental Concepts of Mathematics

UNIT-I : Integral Calculus

Bernoulli's formula for integration by parts - Reduction formulae

for: $\int x^m e^{ax} dx$, $\int \sin^n x dx$, $\int \cos^n x dx$ (with proof & problems),

$\pi/2$

$\int \sin^m x \cos^n x dx$ (no proof, problems only), properties of definite

0

integrals and simple problems.

UNIT-II: Application of Integration

Evaluation of double, triple integrals - Simple applications to area, volume -Fourier series for functions in $(0, 2\pi)$ and $(-\pi, \pi)$.

UNIT-III: Partial Differential Equations

Formation, complete integrals and general integrals - Four standard types, Lagrange's equations.

UNIT-IV : Laplace Transforms

Laplace Transformations of standard functions and simple properties - Inverse Laplace transforms - Applications to solutions of linear differential equations of order 1 and 2-simple problems

UNIT-V: Vector Analysis

Scalar point functions - Vector point functions - Gradient, divergence, curl - Directional derivatives - Unit to normal to a surface - Line and surface integrals - Gauss, Stoke's and Green's theorems(without proofs) - Simple problem based on these Theorems.

Recommended Text

1. P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics*, Vol. I & II. Muhil Publishers, Chennai

Reference Books:

1. P.Balasubramanian and K.G.Subramanian,(1997)*Ancillary Mathematics*. Vol. I & II. Tata McGraw Hill, New Delhi.
2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II. Vikas Publications, New Delhi.
3. P.R.Vittal(2003). *Allied Mathematics* . Marghan Publications, Chennai.
4. P.Kandasamy, K.Thilagavathy (2003) *Allied Mathematics Vol-I, II* S.Chand & company Ltd., New Delhi-55.
5. Isaac, *Allied Mathematics*. New Gamma Publishing House, Palayamkottai

SEMESTER III
PAPER – 3
DISTRIBUTION THEORY

Objective:

To enable the students to understand the properties and applications of various probability functions.

UNIT – I

Discrete distributions: Binomial, Trinomial and Multinomial distributions and their properties - Poisson, Negative Binomial and Geometric distributions and their properties.

UNIT – II

Continuous distributions: Normal, Uniform, Exponential, Gamma and Beta distributions and their properties.

UNIT – III

Bivariate Normal Distribution and its properties. Partial and multiple correlation and regression – Concepts and simple problems.

UNIT – IV

Basic Central Limit Theorem (statement only) - Limiting distributions : Poisson distribution as a limiting case of Binomial - Poisson distribution as a limiting case of Negative Binomial distribution - Convergence of Binomial, Poisson, Gamma and Chi-square distribution to Normal distribution using Moment generating function.

UNIT – V

Order statistics-distribution of first, n^{th} and i^{th} order statistics, joint distribution of r^{th} and s^{th} order statistics-distribution of median and range. Simple problems.

Books for Study:

1. Gupta, S. C and Kapoor, V. K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Books for Reference :

1. Hogg, R. V and Craig, A. T (2002), Introduction to Mathematical Statistics, Pearson Education Asia, India.

ALLIED - 2

PAPER - 3

NUMERICAL METHODS

Objective:

To enable the students to establish mathematical functions using numerical data and to estimate functional relationship, interpolate and extrapolate the value of dependent variable, find maxima and minima using differentiation

UNIT – I

Finite differences-forward and backward differences, operators E and Δ , and their basic properties, Interpolation with equal intervals: Newton's forward and backward differences-simple problems.

UNIT – II

Interpolation with unequal intervals: Divided differences and their properties, Newton's divided differences formula and Lagrange's formula for interpolation-simple problems.

UNIT – III

Central difference interpolation formula-gauss forward and backward differences formulae-Stirling, Bessel's Everett's central difference formula.

UNIT – IV

Inverse interpolation-Lagrange's method-iteration of successive approximation method-simple problems. Numerical differentiation- Numerical differentiation upto 2^{nd} order only-simple problems.

UNIT – V

Numerical integration-Trapezoidal rule-simpsons $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rules-Weddle's rule-Euler's summation formula.Numerical method of solution of ordinary differential equations-Taylor's series method-Euler method and Runga Kutta upto second order –simple problems.

Books for Study:

1. Numerical Methods by P.Kandasamy, K.Thilagavathy and K.Gunavathi, S.Chand, New Delhi.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.

Books for Reference:

1. Calculus of finite differences and Numerical analysis by Gupta-Malik, Krishna Prakastan Mandir, Meerut.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.
3. Numerical Analysis by B.D. Gupta, Konark publishing.
4. Calculus of finite differences and Numerical Analysis by Saxena, S. Chand & Co.
5. Numerical mathematics by M.M.Ramasamy and Palaniappan.
6. Introductory Methods of Numerical Analysis by S.S.Sastry, Printice Hall of India, New Delhi.

SKILL BASED SUBJECT

PAPER - 1

INDIAN OFFICIAL STATISTICS

Goal:

Objective :

To enable the students to understand how the statistics are collected, recorded and published .

UNIT – I

Statistical organization – Population Statistics – Agricultural Statistics – Indices of Agricultural production – Miscellaneous Agricultural Statistics.

UNIT – II

Industrial statistics – ASI – Indices of Industrial Production and profits.

UNIT – III

Price statistics – Price index numbers – Labour Bureau; Index number of Retail prices – Indices of security prices.

UNIT – IV

Wage statistics – trade statistics – Financial statistics – National income statistics.

UNIT – V

National sample surveys – Activities and publications of CSO and the Department of Statistics, Government of Tamil Nadu. National Income compilation.

Books for Study:

1. Gupta SP : Statistical Methods (Sultan Chand & Sons)
2. Saluja, M.R (1972): Indian official statistical systems: Statistical publishing society, Calcutta and The Indian Econometric Society, Hyderabad.
3. Central Statistical Organisation, Guide to Official Statistics 1979 Ed Department of Statistics, Ministry of Planning, India.

NON-MAJOR ELECTIVE

PAPER – 1

STATISTICAL METHODS-I

Objective:

To introduce a few concepts in statistics for other major students

UNIT – I

Diagrammatic and Graphical representation of data- Descriptive Measures – Mean, Median, standard deviation, skewness (ungrouped data only).Data analysis through diagram and graphs.

UNIT – II

Elements of Compound interest(nominal and effective rates of interest, annuities certain, present values, accumulated amounts, deffered annuities)-the functions included in compound interest – tables and their uses.

UNIT – III

Concept of sample and Population-Preparation of questionnaire and Pre-testing – Simple random ,Stratified random and Systematic sampling techniques.

UNIT – IV

Study of relationship between variables: Concept of correlation- Partial correlation, Multiple correlation (three variables only) and simple problems. Qualitative: Contingency tables – Measures of Association.

UNIT – V

Concept of Regression, Multiple Regression model (Three variables only)-Simple problems.

Books for Study:

1. Gupta,S.P.: Statistical Methods, Sultan Chand& Sons Pvt Ltd.New Delhi.
2. Federation of Insurance Institutes Study Courses- Mathematical Basis of Life Assurances F1,2.

Books for Reference:

1. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.

SEMESTER IV
PAPER - 4
SAMPLING THEORY

Objective:

To enable the students to understand and apply the sampling procedures to different situations.

UNIT – I

Design - Organization and execution of sample surveys - principle steps in sample survey - Pilot survey - principles of sample survey - sampling and non-sampling errors - advantages of sampling over complete census - limitations of sampling.

UNIT – II

Sampling from finite population - simple random sampling with and Without replacement - unbiased estimate of the mean, variance of the estimate of the mean finite population correction estimation of standard error from a sample - determination of sample size.

UNIT – III

Stratified random sampling - properties of the estimates - unbiased estimates of the mean and variance of the estimates of the mean-optimum and proportional allocations - relative precision of a stratified sampling and simple random sampling - estimation of gain in precision in stratified sampling.

UNIT – IV

Systematic sampling - estimate of mean and variance of the estimated mean - comparison of simple and stratified with systematic random sampling.

UNIT – V

Ratio estimators: Ratio estimates, variance of the ratio estimates - Bias of the ratio estimates.
Regression estimators: Linear regression estimate regression estimates with pre assigned b- regression estimates when b is computed from the sample.

Books for Study:

1. William, G. Cochran (1984): Sampling techniques, Wiley Eastern.

Books for Reference:

1. Des Raj (1976): Sampling theory, Tata McGraw Hill.
2. Daroga Singh & Chaudhary, F.S. (1986): Theory and Analysis of Sample Survey Designs. Wiley Eastern.
3. Sukhatme P.V. et al (1984): Sample survey methods and its applications, Indian Society of Agricultural Statistics, New Delhi.
4. Murthy, M.N. (1967): Sampling theory and methods, Statistical Publishing Society, Calcutta.
5. Sampath S. (1999): Sampling theory and methods. New Age International Ltd.
6. Engineering Updates.
7. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.

CORE PRACTICAL - II

(Based on Core Paper 3 and 4)

1. Fitting of Binomial Distribution.
2. Fitting of Poission Distribution.
3. Fitting of Normal Distribution.
4. Simple Random Sampling.
5. Stratified Random Sampling- Proportional Allocation
6. Stratified Random Sampling- Optimum Allocation
7. Systematic Sampling.
8. Ratio Estimator
9. Regression Estimator

ALLIED - 2
PAPER - 4
PROGRAMMING IN 'C'

Objective:

To enable the students to understand and develop programs in C.

UNIT – I

Introduction to “C”, variables, data types-declarations, type conversions, increment and decrement, Bitwise, Logical and Assignment operators.

UNIT – II

Expression and conditional expressions, control structures, If-Else, SWITCH, WHILE, FOR and DO WHILE loop structures. Break continue, GO and Lable statememts. Function, function returning, Non-integers, Function arugements-Static and register variables.

UNIT – III

Arrays and Strings-Array Declaration,Multi dimensional Arrays Strings/Character Arrays,Array initialization-Pointers and addresses.Pointers and Arrays-Pointer to function.

UNIT – IV

Structures and functions,Array of structures Fields,Unions-type definition standard input and output –formatted output-output-Access to the standard library.

UNIT – V

File Access, File handling in C-File descriptions-Error handling-‘Low level i/o-Read and Write’. Open, Create, Close, Unlike-Random Access-seek and I seek.

Books for Study and Reference:

1. Balagurusamy,E.(1997):ANSI ‘C’Programming,Tata-McGraw Hill Publishers Ltd.
2. Yaswant Kanetkar(1997): Let Us ‘C’,BPB Publications, New Delhi.
3. Bruce,H.Hunter:Introduction to ‘C’

ALLIED PRACTICAL - I

NUMERICAL METHODS & PROGRAMMING IN 'C' (Based on Allied Papers 3 and 4)

Summation of Series :

1. Sin(x), 2. Cos(x), 3. Exp(x) (Comparison with built in functions)

String Manipulation :

1. Counting the no. of vowels, consonants, words, white spaces in a line of text and array of lines.
2. Reverse a string & check for palindrome.
3. Substring detection, count and removal
4. Finding and replacing substrings

Matrix Manipulation :

1. Addition & Subtraction
2. Multiplication
3. Transpose, and trace of a matrix
4. Determinant of a Matrix

Solution of polynomial equation-Newton Rapson method

Solution of system of simultaneous equation-Gauss elimination method.

Lagrange interpolation.

Numerical integration by Trapezoidal, Simpson's and Weddle's rules.

Calculate the value of π (up to five decimal places).

Check the accuracy of the built in functions Sin(x), Cos(x), (x in radians) e^x, e^{-x} .

Generation of Fibonacci Sequence.

Matrix addition, multiplication, inverse, transpose, determinant of square matrix.

Solution of simultaneous equations by Iterative methods and by using inverse.

SKILL BASE SUBJECT
PAPER - 2
INDUSTRIAL STATISTICS

Objective:

To make the students to understand inventory policies

UNIT – I

Inventory Planning: Concept of planned inventory policies – Deterministic models – Policy when inventory levels are reviewed continuously and demands occur uniformly with and without shortage costs – Economic Order quantity.

UNIT – II

Policy for production planning when inventory levels are reviewed periodically – Stochastic models – Single period model with no set up cost having zero or non – zero initial stock $\{(s,S)$ Policy}.

UNIT – III

Forecasting: Concept of forecasting and its applications in manufacturing and non – manufacturing industrial Situations – Methods of forecasting including average, last value, weighted average (exponential smoothing).

UNIT – IV

Reliability: Definitions and relationships between survival function, hazard function, hazard rate of a non –negative random variable – parametric distributions :weibull, Gamma, Lognormal and Exponential as life time distributions – Concept of aging, IFR, IFRA classes of distributions and their dual.

UNIT – V

Coherent system as binary function : Minimal cut and path sets (vectors) – Representation of Structure function of series, parallel and k out of n: G systems of independent components – Minimal cut and path structure functions – Dual of a coherent structure – Derivation of reliabilities of above structures.

Books for study:

1. Taha H A(1999): Operations Research,Macmillan Publishing Co.
2. Hiller F S and Libermann G J (1995): Introduction to Operations Research, 6th Edition,McGraw Hill.
3. Bain L J and Enghardt(1991): Statistical Analysis of Reliability and Life Testing Models,Marckel Dekkar.

Books for Reference:

1. Zacks S (1992): Introduction to reliability Analysis, Probability models and Statistical methods, Springer Verlag.
2. Barlow R E and Proschan F(1975): Statistical Theory of Reliability and Life testig:Probability models,Holt,Rinehart and Winston.

NON-MAJOR ELECTIVE
PAPER - 2
STATISTICAL METHODS-II

Objective:

To introduce a few concepts in statistics for other major students

UNIT – I

Population growth and change-arithmetic, geometric and exponential growth rates- Population estimation and projection.

UNIT – II

Measures of mortality- Crude and Specific rates- Infant mortality rate –direct and indirect standardization of death rates – Complete life table.

UNIT – III

Non- Parametric tests- Sign test, Wilcoxon test, Mann-Whitney U Test.

UNIT – IV

Non Parametric Tests- Median test, Run test, Kolmogrov – Smirnov One Sample test.

UNIT – V

Chi- Square Tests- Goodness of fit (Excluding fitting of Distribution)- Test of independence of attributes.

Books for Study:

1. Gupta,S.P.: Statistical Methods, Sultan Chand& Sons Pvt Ltd.New Delhi.
2. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics Sultan Chand & Sons.

Books for Reference:

1. Rohatgi, V.K. (1984) An introduction to probability theory and mathematical statistics, Wiley Eastern.

SEMESTER V

PAPER – 5

STATISTICAL INFERENCE – I

Objective:

To enable the students to understand and apply various estimation procedures

UNIT – I

Sampling distributions - concept - distributions of mean and variance from Normal population. Sampling distributions : Chi-square, Student's t and F distributions - Derivation of their density functions and their properties

UNIT – II

Point Estimation - Problem of Point estimation - Properties of estimators- Consistency and Efficiency of an estimator. Sufficiency of a statistic - Neyman- Fisher factorization theorem (discrete case) - Simple problems.

UNIT – III

Unbiasedness - Properties, MVUE, BLUE, Rao - Blackwell theorem-Sufficiency and completeness, Lehman- Scheffe theorem, Cramer- Rao inequality - simple problems.

UNIT – IV

Methods of estimation: Method of Moments, Method of Maximum Likelihood, Method of minimum chi-square, Method of modified minimum chi-square, method of least squares-properties of estimators obtained by these methods -simple problems.

UNIT – V

Interval Estimation - Confidence Interval for proportions, mean(s), variance, and variance ratio based on chi square, student's t, F and Normal distributions. Tests of significance: concepts - tests based on normal, t, F, and Chi Square.

Books for Study:

1. Mood, AM. Graybill , F.A. and Boes, D.C. (1974) : Introduction to the theory of Statistics, McGraw Hill.
2. Hogg R.V. and Craig, A.T. (1972): Introduction to mathematical statistics, 3rd edition, Academic Press, USA.
3. Goon, A.M. Gupta, M.K., and Das Gupta, B. (1980): An outline of statistical theory, Vol.I, 6th revised ed. World Press limited, Calcutta.

Books for Reference:

1. Hoel, P.G. (1971) : Introduction to mathematical Statistics, Asia publishing house.
2. Rohatgi, V.K. (1984) An introduction to probability theory and mathematical statistics, Wiley Eastern.
3. Degroot, M.H. (1975): Probability and Statistics, Addison – Wesley
4. Marek Fisz (1961): Probability theory and Mathematical statistics, John Wiley.
5. Spiegel, M.R. (1982): Theory and problems of probability and statistics, Schaum's outline series, McGraw Hill
6. Snedecor, G.W. and Cochran, W.G. (1967): Statistical methods 6th edition, Oxford IBH Publishing Co.
7. Wilks, S.S. (1962): Mathematical statistics - John Wiley & Sons.

PAPER - 6
STATISTICAL QUALITY CONTROL

Objective:

To enable the students to know the concepts of process control and product control

UNIT - I

Need for Statistical Quality Control techniques in Industry - Causes of Quality variation control charts - Use of the Shewhart - control chart - Specification and tolerance limits - 3 sigma limits - warning limits - application of theory of runs in quality control.

UNIT – II

Control chart for variables - X chart ,R chart, σ chart - purpose of the charts - Basis of sub grouping - plotting X and R results - determining the trial control limits - Interpretation of control charts X and R.

UNIT – III

Control chart for attributes - purpose of the chart - p chart - np chart - construction of p and np chart - choice between chart for P and chart for np - construction of c-chart.

UNIT – IV

Acceptance of sampling plans for attributes - Producer's risk and consumer's risk - concepts of AQL, LTPD, AOQ, AOQL, ATI and ASN - single, double and Multiples sampling plans - OC, AOQ, ATI curves for single and Double sampling plans.

UNIT – V

Variable sampling plans - Sigma known and sigma unknown determination of n and k for one sided specification - OC curve.

Books for Study:

1. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.
2. Gupta, R.C.(1974): Statistical Quality Control.

3. Montgomery, D.C. (1983): Introduction to Statistical Quality Control, John Waley & Sons.
4. Ekambaram, S K. (1963): Statistical basis of Acceptance sampling, Asia Publishing House.

Books for Reference:

1. Grant, E,L. and Laven Worth, R.S.: Statistical Quality Control, McGraw Hill.

PAPER - 7
OPERATIONS RESEARCH

Objective:

To enable the students gain knowledge about various optimization techniques

UNIT – I

Introduction to OR, Nature, Scope, Functions, Linear programming problem - Formulation of LPP - Solving the LPP by graphical method.

UNIT – II

Solving the LPP by simplex method, Big-M method, Duality in LPP, Dual simplex method.

UNIT – III

Transportation problem- obtaining initial, feasible and optimal solutions. Optimality test degeneracy, Unbalanced transportation problem, Assignment problem, and unbalanced assignment problem - Traveling salesman problem.

UNIT – IV

Game Theory - Two person zero sum games, The maximin - minimax principle - Games without saddle points - Mixed strategies - Graphical solution of $2 \times n$ and $m \times 2$ games Dominance property. Sequencing - 'n' jobs through 2 machines - 'n' jobs through 3 machines - 'n' jobs through 'm' machines, Two jobs and 'm' machines.

UNIT – V

Network analysis by CPM / PERT basic concepts - constraints in Network - construction of the network - Time calculations - Concepts of slack and float in Network Analysis - finding optimum project duration and minimum project cost, finding expected project time and variance.

Books for Study:

1. Kanti Swamp et al: Operations Research, suichand and Sons, New Delhi.
2. Sharma J.K. (2001): Operations Research. Theory and applications, Macmillan India Ltd.

Books for Reference:

1. Handy A. Taha (1996): Operations Research, 6 ed. Prentice Hall of India
2. Goel & Mittal (1982): Operations Research, Pragati Prakashan, Meerut.
3. Gupta R.K.(1985): Operations Research, Krishna Prakashan, Mandir, Meerut.
4. Schaum's outline series : Operations Research.
5. Frederick S.Hillier & Gerald J.Lieberman: (1987) Operations Research, CBS publishers & Distributors, Delhi.
6. Sharma J.K. (2002): Operations Research. Problems and solutions, Macmillan India Ltd.

PAPER – 8
APPLIED STATISTICS

Objective:

This course introduces the basic Statistical tools in time related Variables, economic variables. To enable the students understand index numbers and other Statistical tools applied to demographic and chorological data

UNIT – I

Time series - Concept - Components of time Series - Additive and multiplicative models - Measurement of trend – free hand method-semi average method-Moving average method - Least square method.

UNIT – II

Measurement of seasonal variations - Simple average method - Ratio to trend method - Ratio to moving average method - Link relative method - Variate Difference method.

UNIT – III

Index Numbers - uses, classification of index numbers - Problems in the construction of index numbers - Methods of constructing index numbers - Unweighted index numbers - weighted index numbers.

UNIT – IV

Quantity index numbers - Fixed and chain base index numbers - Optimum test for index numbers - Time reversal test - factor reversal test - cost of living index numbers.

UNIT – V

Demand Analysis Theory and analysis of consumer s demand Law of demand, Price elasticity of demand estimation of demand curves forms of demand functions - Demand and Supply utility and indifference maps determination of price and supply and demand

Books for Study:

1. Kapoor,V.K and Gupta,S.C (1978); Fundamentals of Applied Statistics, Sultan chand & Sons.

Books for Reference:

1. Gupta, S.P (1999): Statistical Methods, Sultan & Sons, New Delhi.
2. Croxton, F.E & Cowdon, D.J. (1973): Applied general statistics, Prentice Hall
3. Mukhopadhyay P.(1999): Applied Statistics,New Central Book Agency Pvt.Ltd.,Calcutta.

ELECTIVE

PAPER - 1

A. DEMOGRAPHY

Objective:

To make the students to understand the application of statistical methods in population related problems

UNIT – I

Sources of Demographic data – Civil Registration- Population Census – Population Registers – Errors in Demographic data – Methods of Improvement.

UNIT – II

Mortality measurements –Merits and Demerits - general and specific rates – standardized rates – age pyramid of sex composition – Ratios, proportions and percentage rates – Population pyramids, sex ratio, crude rate, specific rates, standard rates – direct and indirect.

UNIT – III

Fertility, Measures of fertility, General fertility rate, Specific fertility rate, Net reproduction rate, Gross reproduction rate, Crude Rate of natural increase. Definition – stable population and stationery population.

UNIT – IV

Life table - Structure - Construction – Relationship between function of the life table – abridged life table (Concept only)

UNIT – V

Population estimation and projection, component method of population projection Forces of mortality - Gompertz and Makcham law logistic curve fitting and its use.

Books for Study and Reference:

1. Srivastava, O.S (1983): A text book Demography, Vikas Publishing
2. Bogue, Donald, . J: Principles of Demography, (1976), John Wiley, New York.

B. DATA BASE MANAGEMENT SYSTEM

Objective:

To enable the students to understand classifying and grouping and retrieve the mass data.

UNIT – I

Introduction – DBMS Basic Concepts – Purpose of Database Systems – Database System/ File System – Overall System architecture – Database Languages – Classifications – Data Models.

UNIT – II

Entity relationship model: Mapping constraints – Primary Keys – Foreign Key – Structural Constraints – ER notations- ER model examples – Enhanced Entity Relationship Model: EER Concepts like Generalization, Specialization, Union, Category, Disjoint, Overlapping etc.EER model examples.

UNIT – III

Relational Data Base Design – ER/EER to Relational Mapping algorithm – Relational Model: Structure – Formal Query Languages – Relational Algebra – Informal Design Guidelines – Functional Dependencies – Normalization upto third Normal Form.

UNIT – IV

SQL – Basics of SQL – DDL – DML – DCL – TCL Commands in detail with examples.

UNIT – V

PL/SQL: Stored Procedure Concepts – Procedure – Functions – Cursors – Triggers.

Books for study:

1. H.F. Korth and A.Silberschatz (1988): Database system Concept, McGraw Hill Publication.
2. Albert Lulushi (1997): Developing ORACLE FORMS Applications, Prentice Hall

Reference Books:

1. Ramez Elmasri and B. Navathe, Fundamentals of Database Systems (Chapters 1, 2, 3, 4.1, 7, 8, 9, 14), 3/e, Addison Wesley.

C. STATISTICAL GENETICS

Objective:

To enhance the students apply statistical methods in Genetics

UNIT – I

Statistics Genetics: Cells, Chromosomes, Gametes, Genes and Gene frequency, Mendel's law – Single locus with two alleles – Hardy-Weinberg equilibrium – A-B-O blood group system, Calculation of Probabilities of offspring blood group for given parental blood group – Chance of incompatibility.

UNIT – II

Definition of ED50, ED90 etc. – Simple method of estimation of the above. Data: Dose levels (Z,l), number of individuals exposed (n,l), number responding (r,l). Simple regression of probit on log dose to estimate parameters of tolerance distribution.

UNIT – III

Introduction to logistic regression with binary response and one independent variables (continuous) – Exponential and logistic model of population growth, solving the following differential equations: $DNt/dt=kNt$, $dNt(k-Nt)$. Fitting the above growth models to data by linearization and regression.

UNIT – IV

Capture-recapture method of abundance estimation. One and two recapture occasions. Use of likelihood under binomial distribution – Concept of biodiversity. Simpson's and Shannon-Wiener indices.

UNIT – V

Study of exponential and Weibull distributions as models for survivorship data. Corresponding hazard functions and interpretation of their shapes. Applications to environmental data.

Books for Study:

1. D.J.Finney(1978): Statistical Methods in Biological Assays, Charles Griffics & Co.
2. A.P.Gore and S.A. Paranjpe(2000): A course in Mathematical & Statistical Ecology, Kluwer.

Books for References:

1. R.C. Elandt Johnson (1975): Probability Models and Statistical Methods in Genetics Wiley.
2. C.C.Li(1976): First course in Population Genetics, Boxwood Press.

SKILL BASED SUBJECT
PAPER-3
APPLIED DECISION MAKING

UNIT – I

Decision problem: Goals and objectives – Conflict between goals – Possible solutions – Constrains – Feasible solutions – Objective function – Costs and benefits, notions and criteria for optimality.

UNIT – II

Steps in decision making: Determining objective(s), identifying alternative feasible solutions, determining (expected) costs and benefits associated with a feasible solution, developing a measure of effectiveness, finding the optimal solution- Sensitivity analysis and post – optimality problems – controlling a solution.

UNIT – III

Structure of decisions-Development of the pay-off measure – Bernoullian utility – Expected value – Pay-off without a natural measure – Standard gamble – Strategies and states of nature – Analysis of decisions – Pay-off matrix – Decisions under certainty, uncertainty, risk and competition – Optimality criteria of pessimism, optimism and regret – A decision among decision criteria – Laplace criterion.

UNIT – IV

Sequential decisions – Decision trees – Informal analysis of decision trees – Cutting decision trees – Decision-making using expected money value and utility- Expected profit with perfect information – Value of sample information – Expected net gain due to sampling.

UNIT – V

Decision problems in marketing – Brand-loyalty model – Brand-share model – Pricing problem – Competitive bidding – Allocation of advertising funds Decision problems in finance – Investment decision trees – Risk analysis – Porfolio selection – Dividend policy.

Books for study:

1. Raiffa H and Schlaifer R (1968): Applied Statistical Decision Theory, MIT press.
2. Johnson R D and Siskin B R (1976): Quantitative Techniques for Business Decisions, Prentice-Hall, India.

Books for Reference:

1. Kemeny J G, Schleifer Jr. A., Snell J L and Thompson GL (1968): Finite Mathematics with Business Applications, Prentice-Hall, Indian.

SEMESTER VI
PAPER - 9
STATISTICAL INFERENCE – II

Objective:

To give detailed idea of estimation, testing of hypothesis and Non-Parametric Tests to the under graduate students.

UNIT – I

Testing of Hypothesis - Neyman - Pearson theory - Statistical Hypothesis - Simple and composite hypothesis, Null and Alternative Hypothesis - Two types of errors - critical region- powers of a test - Most powerful test – Neyman-Pearson lemma - simple problems

UNIT – II

Uniformly most powerful tests, Likelihood ratio criterion - Definition and test for means and variance (one sample only).

UNIT – III

Sequential Probability Ratio Test: Definition - properties and simple problems.

UNIT – IV

Non-parametric tests - Run, Median, sign and Mann Whitney tests (one sample and two sample) problems. Wilcoxon Signed rank test, test sum test, Kolmogorov's Smirnov one sample test, and Kruskal Wallis test.

UNIT – V

Basic ideas on decision theory - Loss functions - Risk functions - Prior distributions - Bayes Risk - Simple problems based on Bayes estimation and testing.

Books for Study and Reference:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (1974): Introduction to the theory of Statistics, McGraw Hill.
2. Hogg R.V. and Craig, A.T. (1972): Introduction to mathematical statistics, 3rd edition, Academic Press, USA.

3. Goon, A.M. Gupta, M.K., and Das Gupta, B. (1980): An outline of statistical theory, Vol.I, 6th revised ed. World Press limited, Calcutta.
4. Hod, P.G. (1971): Introduction to mathematical statistics, Asia publishing house.
5. Rohatgi, V.K. (1984) An introduction to probability theory and mathematical statistics, Wiley Eastern.
6. Marek Fisz (1961): Probability theory and Mathematical statistics, John Wiley.
7. Spiegel,M.R. (1982): Theory and problems of probability and statistics, Schaum's outline series, McGraw Hill
8. Snedecor, G.W. and Cochran, W.G. (1967): Statistical methods 6th edition

PAPER - 10
DESIGN OF EXPERIMENTS

Objective:

To focus on the design and analysis of variance techniques in the statistical field experiments.

UNIT – I

Fundamental Principles of Experiments - Replication, Randomization and Local Control Techniques - Size of experimental unit-Methods of determination of experimental units - (Maximum curvature method-Fairfield Smith's variance law).

UNIT – II

Analysis of Variance - one-way, two-way classification (without interaction) Multiple range tests: Newman Keul's test- Duncan's multiple range test. Tukey's test-Transformations Square root, angular and log transformations.

UNIT – III

Linear Model and its classifications. Completely Randomized Design (CRD) and its analysis- Randomized Block Design (RBD) and its analysis-Latin Square Design(LSD) and its analysis.

UNIT – IV

Missing plot technique-Meaning-Least square method of estimating missing Observations- and two observations missing in RBD and LSD - Analysis of covariance technique in CRD and RBD(without derivation)

UNIT – V

Factorial experiments - Definition 2^2 , 2^3 and 3^2 factorial experiments and their analysis - Principles of confounding-Partial and Complete confounding in 2^3 - Split plot design and its analysis, BIBD concept and parametric Relations.

Books for Study:

1. Dass M.N and Gin N.C (1986) Design and Analysis of Experiments, Wiley Eastern, New Delhi.
2. Kempthorne, (1956) Design and Analysis of Experiments, John Wiley. New York.

Books for Reference:

1. Montgomery, D (1972) Design of Experiments, John Wiley and Sons
2. Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.

PAPER – 11
STOCHASTIC PROCESS

Objective:

To enable the students to know the basic concepts of stochastic processes

UNIT – I

Basic Concepts : Definition and examples of stochastic process, classification of general stochastic processes into discrete and continuous time, discrete and continuous state spaces, types of stochastic processes, elementary problems.

UNIT – II

Markov chains : Definition and examples of Markov chain, Transition Probability Matrix, classification of states, recurrence, simple problems

UNIT – III

Basic limit theorem of Markov chain (statement only), stationary probability distribution, applications.

UNIT – IV

Continuous Time Markov chain : Pure birth process and Poisson process, Birth and Death process, problems.

UNIT – V

Branching process : Definition and examples of discrete time branching process, probability generating function, mean and variance, probability of extinction, simple problems.

Books for Study and Reference:

1. Karlin, S. and Taylor, H.M. (1975): A first course in Stochastic processes, Academic press.
2. Hoel, P.M.G., Port, S.C. and Stone, C.J. (1991): Introduction to Stochastic processes, Universal Book Stall.
3. Parzen, E. (1962): Stochastic processes, Holden-Day.
4. Cinlar, B. (1975) Introduction to Stochastic processes, Prentice Hall.

5. Adke, S.R. and Manjunath, S.M. (1984): An introduction to Finite Markov Processes, Wiley Eastern.
6. Medhi, J. (1996): Stochastic processes, New Age International (p) Ltd.
7. Ross, S.M. (1983): Stochastic processes, John Wiley.
8. Taylor, H.M. and Karlin, S. (1999): Stochastic Modelling, Academic press

CORE PRACTICAL III

1. Non-parametric methods:

- a. Sign test
- b. Signed rank test
- c. Median test
- d. Mann Whitney U-test
- e. Test of randomness of sample.

2. X Bar Chart ,R Chart, σ chart.

3. p,np and c chart.

4. Test of Hypothesis :

Power of the test ,level of significance.

5. Test of significance

- i. Mean and variance.
- ii. Difference of means.
- iii. Equality of two variances from normal distribution
- iv. Test of significance of correlation coefficients

6. Confidence interval for mean, variance.

7. Partial and Multiple Correlation.

8. Partial and Multiple Regression.

9. Analysis of Variance - one-way and two-way.

10. Design of Experiment –CRD.

11. Design of Experiment-RBD.

12. Design of Experiment-LSD.

13. Missing plot technique- one missing frequency.

14. Factorial experiments – 2^2 , 2^3 , 3^2 experiments with total and partial confounding.

ELECTIVE

PAPER-2

A. MATHEMATICAL ECONOMICS

Objective:

To enable the students to learn mathematical and statistical tools in Economics

UNIT – I

Scope and methods of Mathematical Economics – Laws of demand , Demand schedule (Individual and Market) - Demand function - Factors influencing the demand - Exception to the law of demand – Elasticity of demand with respect to price and income - Factors affecting the elasticity of demand - Partial elasticity of demand with respect to price - Simple problems in elasticity of demand.

UNIT – II

Supply - Factors affecting the supply of a commodity - Relation between demand and supply – Utility - Concept of utility - Concept of human wants - Maximization of utility - Marginal and total utility - Law of diminishing marginal utility - Indifference curves and map - Properties of indifference curve - Price line.

UNIT – III

Cost Analysis – Different types of cost - Total, average and marginal cost functions - Relation between average and marginal costs - Problems related to total, average and marginal costs – Revenue - Total, average and marginal revenue functions and their relationship - Simple problems related to maximization of total revenue

UNIT – IV

Market Structure – Definition of Market - Perfect completion - Pure competition - Monopolistic competition and duopolistic competition (Only concept) - Profit maximisation – Profit function - Cournot solution to monopoly problem for maximization problem - Joint monopoly and discriminating monopoly - Problems related to profit maximization under monopoly. Duopoly - Conjectural variation and reaction curves - Simple maximization problem under duopoly.

UNIT – V

Theoretical Production functions – Mathematical definition of production function - Constant product curves (Isoquant) - Average and marginal productivity - Homogenous production functions – Properties of linearly homogeneous production function – Cobb-Douglas production function – C. E. S. production function

Books for Study:

1. Varma and Agarwal (1998): **Managerial Economics**, Sultan Chand and Company, New Delhi.
2. Mehta and Madhnani (2001): **Mathematics for Economists**, Sultan Chand and Company, New Delhi (Chapters 6, 8, and 9).

Books for Reference:

1. Allen R.J.D.(1979): **Mathematical Economics**, Macmillan Press

B. REAL ANALYSIS I

Objective:

To make the students get understanding sequence, limits and mean value theorems.

UNIT – I

Sets: Sets - elements - Operations on set. Functions : Real valued functions equivalence - Countability - Real numbers - Upper and Lower bounds- Supremum and Infimum.

UNIT – II

Sequence of real numbers : Limit of a sequence - Convergent sequences, Divergent sequences - Bounded sequences - Monotone sequences Cauchy's first and second theorem on limits Cauchy's general principle of convergence

UNIT – III

Series of real numbers : Convergence and divergence - series with non-negative terms - comparison test D'Alembert's ratio test, Cauchy's Root test – Alternating. Series - Conditional convergence and absolute convergence Leibnitz test.

UNIT – IV

Functions: Limit of real valued functions in one variable, continuity types of discontinuities algebra of continuous functions Extreme value theorem. Intermediate value theorem Uniformly Continuous functions

UNIT – V

Differentiability of Functions Rolle's theorem Mean value theorem for derivatives. Taylor's Series expansion application to maxima and minima

Books for Study:

1. D. Somasundaram and B. Choudhary (2002) : A first course in Mathematical Analysis, Narosa Publishing house.
1. R. R. Goldberg (1970) : Methods of Real Analysis, Oxford & IBH.
2. W. Rudin(1976): Principles of Mathematical Analysis, 3/e, McGraw Hill Company.

Books for Reference:

1. T. M. Apostol(1985): Mathematical Analysis, Narosa Publishing House.

C. ACTUARIAL STATISTICS

Objective:

To impart basic concepts in actuarial studies and to make the students to take up the career in Actuarial Practice

Unit – I

Effective Rate of Interest i – Nominal Rate of Interest $i^{(m)}$ - Force of Interest δ - Relationships between different rates of interest – Expression for δ by use of calculus –Present values – Effective rate of discount d – Nominal rate of discount $d^{(m)}$.

Unit – II

Annuities – Immediate Annuity – Annuity – due – perpetuity – accumulation and Present values of Annuities – Increasing and Decreasing annuities – Annuities and interest rates with different frequencies – Continuous Annuities.

Unit – III

Analysis of Annuity payments – Capital and Interest elements included in the Annuity payments – loan outstanding after t payments – purchase price of Annuities – Annuities involving income tax – Purchase prices of an annuity net of tax.

Unit –IV

Stochastic interest rates – Independent annual interest rates – The definition of S_n – Mean and variance of S_n – Definition of A_n – Mean and variance of A_n – Simple problems.

Unit – V

Probabilities of living and dying – The force of mortality μ_x – Estimation of μ_x – Uniform Distribution of deaths – Select and Ultimate rates.

Books for Study and Reference:

1. Donald, D.W.A.(1975).Compound Interest and Annuities certain. Heinemann, London.
2. Frank Ayres,J.R.(1983).Theory and problems of mathematics of Finance. Schaum's outline series, McGraw hill book company, Singapore.
3. Mc Cutcheon J.J.and Scott.(1989).Mathematics of Finance, Heinemann, London.
4. Neill,A(1977).Life Contingencies, Heinemann, London.

ELECTIVE

PAPER - 3

A. REGRESSION ANALYSIS

Objective:

To make the students to understand regression models and predictions

UNIT – I

Simple Regression model: Description of data model – Estimation and test of hypotheses – Index of fit – Predicted values and standard errors – Evaluation of fit – Analysis of residuals.

UNIT – II

Simple Regression model: Effect of outliers in simple linear regression – Model adequacy and residual plots – Deletion of data points – Transformation of variables – Transformations to stabilize variance – Removal of heteroscedasticity – Principle of weighted least squares.

UNIT – III

Multiple regression model: Description of data model – Properties of least square estimators – Predicted values and standard errors – Multiple correlation coefficient – Selection of variables – Forward selection procedure – Backward elimination procedure – Stepwise method (algorithms only).

UNIT – IV

Test of hypothesis on the linear model – Assumption about the explanatory variable – Testing a subset of regression coefficients equal to zero – Testing of equality of regression coefficients.

UNIT – V

Multicollinearity and its effects on inference and forecasting – Detection of multicollinearity – Searching of linear functions of regression coefficients – Method of overcoming multicollinearity problem, Ridge method.

Books for study:

1. S. Chatterjee and B.Price (1977): Regression Analysis by Example, John Wiley & Sons, New York. Chapter 1,2,3 and relevant portions in chapters 4,5,6,7,8,9
2. N.R.Draper & H.Smith(1981), Applied Regression Analysis, Second Edition.

Books for Reference:

Johnston J.(1984): Econometric Methods.

B. REAL ANALYSIS II

Objective:

To make the students get understanding Riemann Integration, convergence and metric space.

UNIT – I

Riemann Integration : Definition of the Riemann Integral Existence of the Riemann Integral Properties of the Riemann Integral - Fundamental theorems of Calculus -Mean Value Theorems.

UNIT – II

Improper Integrals their convergence and evaluation, convergence of Beta and Gamma integrals

UNIT – III

Sequences of Functions: Point wise convergence of Sequences of functions Uniform convergence of Sequences of functions Consequences of Uniform Convergence Properties without proof.

UNIT – IV

Series of Functions: Convergence and uniform convergence of series of functions. Weisstrass test - Integration and differentiation of series of Functions Abel Summability.(without proof) - Application

UNIT – V

Metric Space definitions and examples, continuous functions on metric spaces Open sets, closed sets and closure properties.

Books for Study:

1. D. Somasundaram and B. Choudhary (2002) : A first course in Mathematical Analysis, Narosa Publishing house
2. R. R. Goldberg (1970) : Methods of Real Analysis, Oxford & IBH.

Books for Reference :

1. T. M. Apostol(1985) : Mathematical Analysis, Narosa Publishing House
2. W. Rudin(1976): Principles of Mathematical Analysis, 3/e, McGraw Hill Company.

C. ECONOMETRIC METHODS

Objective:

To impart knowledge of inference techniques for economic phenomena.

UNIT – I

Nature of Econometrics – Model building – Role of econometrics – Structural and reduced forms.

UNIT – II

The two variable linear model – Least squares estimators – Properties of the least squares estimators – Inference in the least squares model.

UNIT – III

The k – variable linear model – Assumptions of the linear model – Ordinary least squares (OLS) estimators – Properties of OLS estimators – Gauss – Markov theorem – Inference problems.

UNIT – IV

Problems in linear model – Multicollinearity – specification error – Autocorrelation – Heteroscedasticity.

UNIT – V

Special models – Dummy variables, Lagged variables – Sources of lagged variables – Koyck scheme and Almon lags.

Books for Study and References:

1. Gujarati, Damodar (1995). Basic Econometrics. McGraw – Hill Book Company, New Delhi.
2. Johnston, J. (1984). Econometric Methods. 3rd edn. McGraw – Hill Book Company, New Delhi.
3. Johnson, A.C, Johnson, M.B and Buse, R.C (1989). Econometrics. Macmillan Publishing Company, Inc. New York.
4. Kelejian, H.H and Oates, W.E (1989). Introduction to Econometrics. Harper and Rao publishers, New York.
5. Kmenta, J. (1971). Elements of Econometrics. Macmillan Publishing Company, Inc. New York.

SKILL BASED SUBJECT
PAPER-4
STATISTICAL DATA ANALYSIS (LAB ORIENTED)

Objective:

To compute the various statistical measures using computers.

1. Descriptive Statistics, Correlation and Regression.
2. Large Sample Tests: Means, Variances and Proportions. Test based on Chi-square statistic: Population variance, Homogeneity of Correlation coefficient, Bartlett's test, and goodness of fit tests.
3. Test based on t statistic: Single men, Difference of means, Paired t test, Correlation coefficient, Regression coefficient.
4. Test based on F statistic: Equality of two population variances
5. Non-parametric tests: Sign test, Wilcoxon test, Mann-Whitney U test, Median test, Run test, Kolmogorov Smirnov one sample test, Kruskal Wallis test.
6. Analysis of variance: One way Classification, Two way Classification.

Note:

Five Questions to be set and candidates may be asked to answer three questions.
